(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 131 934 B1**

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **11.12.91**

(51) Int. Cl.[5]: **G01N 33/53, B01L 3/00**

(21) Application number: **84108246.4**

(22) Date of filing: **13.07.84**

The file contains technical information submitted after the application was filed and not included in this specification

(54) An assay cartridge.

(30) Priority: **15.07.83 US 514170**

(43) Date of publication of application:
23.01.85 Bulletin 85/04

(45) Publication of the grant of the patent:
11.12.91 Bulletin 91/50

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(56) References cited:
WO-A-82/03690
FR-A- 2 369 557
US-A- 4 038 149

(73) Proprietor: **Baxter Diagnostics Inc.**
One Baxter Parkway 2-2E
Deerfield, Illinois 60015-4633(US)

(72) Inventor: **Jolley, Michael Ernest**
34469 North Circle Drive
Round Lake Illinois 60073(US)

(74) Representative: **Strehl, Schübel-Hopf, Groening**
Maximilianstrasse 54 Postfach 22 14 55
W-8000 München 22(DE)

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Description

Background of the Invention

This invention relates to an assay cartridge having a plurality of aligned adjacent wells which are useful as the reaction vessels for immunochemical reactions involving a solid phase and a liquid phase. The assay cartridge has a filter membrane located between the wells and a waste reservoir. By applying a reduced pressure to the waste reservoir, the liquid phase is drawn through the filter and into the waste reservoir. This enables convenient separation of the solid phase reaction products from liquid phase reaction products.

A number of methods exist for the detection of substances of biological origin. One large class of methodology is the immunoassay, where antigens or haptens and their corresponding antibodies are used to probe the sample for each other. One very important variant of the immunoassay is the solid phase immunoassay. (Cf. Catt et al., J. BIOCHEM, 100: 31c (1986); Catt et al., SCIENCE, 158: 1570 (1987); US-A-3,646,346).

Radioactive atoms, such as ^{125}I, ^{131}I, ^{3}H, and ^{14}C for example, are commonly utilized as the label in solid phase immunoassays. The resulting solid phase radioimmunoassays are quite sensitive but suffer commonly recognized disadvantages. The radioactive nature of the label subjects the assay to stringent regulatory requirements, results in a relatively short reagent shelf life and poses a waste disposal problem.

In an attempt to overcome the disadvantages of radioimmunoassays, several alternative labeling methods have been developed. Foremost among these are the enzyme immunoassays (EIA, ELISA) where an enzyme replaces the radioactive label. (cf. US-A-3,551,555). Enzymes commonly utilized as labels are horseradish peroxidase, alkaline phosphatase, B-galactosidase and glucose oxidase. Enzyme immunoassays have an advantage over radioimmunoassays in that the enzyme labels are very stable and special facilities and instrumentation are not required. However, enzyme immunoassays are generally slower and more tedious to perform than radioimmunoassays.

Luminescent labels have been utilized as an alternative to radioactive or enzyme labels. (cf. US-A-4,201,763; US-A-3,992,631; US-A-3,999,948; A. Coons, FLUORESCENT ANTIBODY METHODS; J. Danielli (Editor), GENERAL CYTOCHEMICAL METHODS Vol. 1). Fluorescein is the most commonly used label. Although fluorescence immunoassays possess the ease of use advantage of radioimmunoassays and the reagent stability advantage of enzyme immunoassays, prior art fluorescence immunoassays lack the sensitivity of either radioimmunoassays or enzyme immunoassays. This lack of sensitivity has significance in both research and clinical applications with the result that fluorescence immunoassays have seldom been the assay of choice in these applications.

A solid phase immunoassay utilizes for example (i) a plurality of water insoluble particles of about 10 microns or less in size, or (ii) cells, to which an immunoreactant is attached. The analyte or an analyte containing reaction product is reacted with or in competition with or for the immunoreactant while the particles or cells are in a substantially suspended state. The particles or cells which have, or which through subsequent reaction will have, a luminescent label attached thereto are concentrated by microfiltration to a volume substantially less than the volume of the liquid sample which initially contained the analyte. The lumin escence of substantialy all of the luminescent label attached to the concentrated particles or cells is measured.

The assay utilizes a particulate solid phase comprising cells or a plurality of water insoluble particles about 10 microns or less in size (i.e. diameter). Particles may be bacteria, mammalian cell fragments or a polymeric substrate such as, for example, polystyrene latex. Particles may be substantially transparent to a beam exciting the label and to resulting luminescence.

The speed and sensitivity of the assay are enhanced by reacting the analyte (or an analyte containing reaction product) with or in competition with or for the solid phase where the latter is suspended. The large surface area of the particulate solid phase can bring significant quantities of immunoreactants into the reaction. Substantially suspending the solid phase distributes these immunoreactants throughout the liquid medium containing the analyte (or analyte containing reaction product). This enhances rapid and complete reaction involving the analyte or analyte containing reaction product.

The solid phase of the assay may then be concentrated to a volume substantially less than the volume of the liquid sample by microfiltration. This yields a two-fold advantage. First, the analyte may be concentrated prior to quantitation, thereby increasing the sensitivity of the assays by a factor substantially identical to the concentration factor. Second, the volume of the solid phase may be concentrated to a volume where a luminescense detector such as, for example, a front face fluorometer may observe substantially all of the luminescent label.

The above discussed assay is useful for the quantitation of antigen, hapten or antibody analyte or analyte occurring on or attached to cells or other

particulate material contained in liquid samples of body fluids such as, for example, serum, plasma, urine, saliva or non-body fluids such as, for example, cell culture media, potable water or waste water. Moreover, many biological substances of interest are present in particulate form in nature. Examples are bacterial antigens and mammalian cell surface antigens. The assay for quantitation of analyte occurring on or attached to cells or other particulate material is directly applicable to these systems. Furthermore, essays may be performed on living cells. Soluble proteins, haptens and viruses may be attached by known methods (cf. U.S. Patent No. 4,201,763 by Monthony et al.) to microscopic latex particles, prepared by known procedures (cf. D. Blackley (Editor), EMULSION POLYMERISATION (Applied Science Publishers Ltd., Essex, England 1975)).

The foregoing assay illustrates an advance in fluorescence immunoassay methodology. This advanced methodology will be of greatest benefit to research and clinical diagnosis when automated apparatus are available for its practice. There is a need for an assay cartridge suitable for practicing the above methodology.

FR-A-2 369 557 discloses an assay cartridge with the features included in the first part of claim 1. A seperate filter membrane consisting of a circular piece of specific filter paper is inserted into each individual assay well and rests on the flat bottom of the well. The bottom has an outlet orifice with an inverted frusto-conical shape and such a small inner dimension that it holds the liquid which has passed through the filter under normal (atmospheric) pressure conditions and is emptied when the pressure in the waste reservoir is reduced. The known device is intended to be used for radioimmunological applications.

Another assay cartridge for radioimmunoassays is known from WO 82/03690 which is similar to that of FR-A-2 369 557 in that a generally cylindrical well is provided with a filter element overlaying a bottom opening of the well. The inner wall has an inwardly protruding portion near its bottom end to keep the filter element in place. As before, the upper surface of the filter element has substantially the same cross-sectional area as the upper end of the well.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an assay cartridg which is particularly applicable to fluorescence assay by achieving a sufficient concentration of the solid phase to produce a high output signal.

This object is met by the invention as characterized in claim 1.

Since the interior space of the well above the filter membrane narrows near its bottom, the solid phase will be concentrated into a small area approximating the size of the filter showing through the bottom hole of the well.

Preferred embodiments of the invention are s t forth in the dependent claims.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 shows a pictorial view of the assay cartridge, especially the top plate.

FIG. 2 shows a pictorial view of the assay cartridge, especially the base plate.

FIG. 3 shows a top view of the assay cartridge.

FIG. 4 shows a partial cross-sectional view of the assay cartridge as viewed along the section line A-A of FIG. 3.

FIG. 5 shows the base plate as viewed from above it.

FIG. 6 shows the base plate as viewed from beneath it.

FIG. 7 is a cross-sectional view of the base plate as viewed along the section line B-B of FIG. 5.

FIG. 8 shows a side view of the base plate.

FIG. 9 shows the top plate as viewed from above it.

FIG. 10 shows the top plate and filter membrane joined thereto as viewed from beneath the top plate and filter membrane.

FIG. 11 shows a cross-sectional view of the top plate as viewed along the section line C-C of FIG. 9.

FIG. 12 shows a cross-sectional view of the top plate and filter membrane as viewed along the section line D-D of FIG. 9.

FIG. 13 shows a side view of the top plate.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1, 2, 3 and 4 show the assay cartridge in its completely assembled form. FIGS. 5, 6, 7 and 8 show the base plate prior to such assembly. FIGS. 9, 10, 11, 12 and 13 show the top plate and the rear, front and first and second walls prior to assembly.

Base plate 10 has a substantially rectangular shape when viewed from the perspective of FIGS. 5 and 6. With general reference to FIGS. 2, 5, 6, 7 and 8, base plate 10 has rear 11, front 12 and first 13 and second 14 side surfaces. The surfaces are substantially flat. Base plate 10 has first corner surface 15 and second corner surface 16. These corner surfaces are substantially flat. First corner surface 15 is located between first side surface 13 and front side surface 12. Second corner surface

16 is located between second side surface 14 and front side surface 12.

Base plate 10 has raised ridge 17 as shown in FIGS. 6 and 7. Raised ridge 17 runs substantially along the lower periphery of front 12, rear 11, first 13 and second 14 side surfaces and first 15 and second 16 corner surfaces. Base plate 10 has underside 18 and channel 19 located along the outer periphery of the base plate underside 18 and between base plate underside 18 and base plate ridge 17.

Base plate 10 has seating channels 21 formed by outer ridge 23 and inner ridge 22 as shown in FIGS. 5 and 7. Base plate 10 further has a plurality of support posts 25 also as shown in FIGS. 5 and 7. Base plate 10 still further has port 26 having opening 27 through base plate 10. Port 26 in the preferred embodiment is a tube which extends above base plate 10 as shown in FIGS. 7 and 8.

Base plate 10 has finger grips 29 and 30 which are made up of a plurality of raised finger grip ridges 31.

Top plate 35 is shown in FIGS. 9, 10, 11, 12 and 13. Top plate 35 has a substantially rectangular shape as shown in FIGS. 9 and 10. Top plate 35 has top side 36 and underside 37. Top plate 35 has a plurality of wells 39 located on its top side 36. Wells 39 are adjacent to one another and aligned in a geometric pattern as shown in FIGS. 9, 10 and 12. In the preferred embodiment, an eight by twelve matrix of wells yields a 96 well assay cartridge. Each well 39 has a hole 40 at its bottom which extends to underside 37 of top plate 35. Wells 39 each have an upper wall 41 which has a cylindrical shape and a lower wall 42 having the shape of an inverted frustum. Wells 39 also have a substantially circular ridge 44 which extends slightly above the base 45 of top side 36 as shown in FIGS. 9, 11 and 12. Substantially circular ridges 44 in being raised above base 45 assist in preventing reagents spilling from one well into another. Top plate 35 has rear 48, front 49 and first 50 and second 51 side surfaces. These side surfaces are substantially flat. Top plate 35 also has first 52 and second 53 corner surfaces. First corner surface 52 is located between first side surface 50 and front side surface 49. Second corner surface 53 is located between second side surface 51 and front side surface 49. Top plate 35 further has raised ridge 55 located along the upper periphery of front 49, rear 48, first 50 and second 51 side surfaces and first 52 and second 53 corner surfaces. Top plate 35 has two extended flat areas 58 and 59 of base 45 which are useful for placing decals on the cartridge or for placing a writing surface thereon for allowing information to be written onto the top of the plate. Top plate 35 has finger grips 60 and 61 which are constructed of a plurality of finger grip ridges 62.

With reference to FIGS. 10, 11, 12 and 13, rear 65, front 66 and first 67 and second 68 walls are shown. These walls are serially joined to one another. This is illustrated by second wall 68 being joined to front wall 66 at juncture 69. These j ined walls have a substantially rectangular cross-section as shown in FIG. 10. In the preferred embodiment, walls 65, 66, 67 and 68 are shown as joined to top plate 35 prior to assembly of the cartridge. This is illustrated by rear wall 65 being joined to top plate 35 at juncture 70 as shown in FIGS. 11 and 12.

Filter membrane 71 is shown in FIGS. 10 and 12. Filter membrane 71 is positioned against the portion of underside 37 of top plate 35 to which well holes 40 extend. In the preferred embodiment, filter membrane 71 is joined to this portion of underside 37. Filter membrane 71 thus forms a seal around the periphery of each well hole 40. Filter membrane 71 is the floor of assay wells 39. In the preferred embodiment the filter membrane comprises a single filter unit. This filter unit is shown positioned against the entire portion of underside 37 to which well holes extend. In the alternative, the filter membrane may comprise a unit having holes in it where the unit holes do not align themselves with well holes 40. As a further alternative, the filter membrane may also comprise a plurality of distinct filter units where any given unit is positioned against only some of the well holes but where every well hole has some unit position d against it.

The assay cartridge may be assembled as follows. Seating channels 21 of base plate 10 shown in FIGS. 5 and 7 receive lower end 75 of rear 65, front 66, first 67 and second 68 walls of top plate 35 as shown in FIGS. 10, 11 and 12. The assembled assay cartridge is shown in FIG. 4 where channel 21 has received the lower end of rear wall 65 and front wall 66.

In the assay cartridge's assembled state, top plate 35 is located opposite to and substantially parallel to base plate 10 as shown in FIG. 4. The serially joined rear, front, first and second walls are positioned between base plate 10 and top plate 35. These walls are joined to top plate 35 at juncture 70 as described above, and they are joined to base plate 10 at channel 21 as described immediately above. This joining of the walls to base plate 10 and top plate 35 effectively forms a sealed waste reservoir 74 which is located beneath wells 39 of top plate 35 and inside joined base plate 10, top plate 35 and the four walls. Reducing the pressure in waste reservoir 74 relative to the pressure over the wells will cause fluid in the wells to pass through filter membrane 71 and into the waste reservoir 74. Fluids passing into waste reservoirs 74, i.e. waste products, will be retained in waste

reservoir 74 upon a suitable choice of volume for the reservoir and an appropriate choice of the extent to which port 26 extends above base plate 10.

Rear 65, front 66, first 67 and second 68 walls have respectively rear 76, front 77, first 78 and second 79 side surfaces. These side surfaces are substantially flat as shown in FIGS. 10, 11 and 12. In the assembled assay cartridge, rear base plate side surface 11, rear top plate side surface 48 and rear wall side surface 76 are contiguous and substantially parallel. Front base plate side surface 12, front top plate side surface 49 and front wall side surface 77 are contiguous and substantially parallel. First base plate side surface 13, first top plate side surface 50 and first wall side surface 78 are contiguous and substantially parallel. Second base plate side surface 14, second top plate side surface 51 and second wall side surface 79 are contiguous and substantially parallel.

Rear wall side surface 76 is laterally recessed relative to rear base plate side surface 11 and rear top plate side surface 48 as shown in FIG. 4. Front wall side surface 77 is laterally recessed relative to front base plate side surface 12 and front top plate side surface 49 as also illustrated in FIG. 4. Similarly, but not illustrated, first wall side surface 78 is laterally recessed relative to first base plate side surface 13 and first top plate side surface 50. Second wall side surface 79 is laterally recessed relative to second base plate side surface 14 and second top plate side surface 51. This recession along the first and second walls forms a guideway for an automated device to receive the assembled assay cartridge. The recession along the front and rear walls allows an automated device to maintain proper register over the assay cartridge.

The assay cartridge may have rear 82 and front 83 centering pegs. These pegs extend laterally outward respectively from rear 76 and front 77 wall side surfaces. Rear 82 and front 83 centering pegs are substantially opposed to one another as shown in the preferred embodiment. These centering pegs aid an automated device in maintaining register over the assay cartridge.

Top plate raised ridge 55 and base plate raised ridge 17 have substantially similar configurations. In the preferred embodiment, top plate raised ridge 55 has slightly smaller dimensions than base plate raised ridge 17. This allows stable stacking of assay cartridges in that the top plate raised ridge of an assay cartridge will mate with the base plate raised ridge of the assay cartridg stacked on top of it. Base plate 10 also has channel 19 as a furth r aid in receiving and mating with a top plate raised ridge 55.

As shown in FIG. 3, ridge 23 of top plate 35 has a substantially similar configuration to ridge 55 of base plate 10, but ridge 23 is laterally recessed relative to ridge 55.

Base plate 10 and top plate 35 (with its joined four side walls) are injection-molded from plastic. The preferred plastic material is acrylic but other plastic materials such as, for example, polystyrene or polycarbonate could have been used as well. The filter membrane may have a pore size of about 10 microns or less depending upon the choice of solid phase. 0.2 microns is preferred in the case where the solid phase consists of beads sized about 0.2 microns. A pore size of 5-10 microns may be appropriate for a solid phase consisting of cells or other matter such as that discussed above. The filter membrane in the preferred embodiment is cellulose acetate, but nitro cellulose, polyvinyladine floride, polyvinyl chloride, teflon, polysulfone, polyester, polycarbonate, paper or glass fiber may, for example, also be used. These materials may be used as the filter membrane without pretreatment. The hydrophilic/hydrophobic quality of the filter, however, may be controlled in order to prevent seepage of fluids through the filter due to head pressure alone when no reduced pressure is applied to the waste reservoir. The hydrophilic/hydrophobic quality of the filter membrane may be controlled in known ways such as, for example, treating the filter with a surfactant. As a general rule, for pore sizes of 0.2 microns for cellulose acetate, the filter may be hydrophilic. However, as pore diameters get larger such as in the 5-10 micron range, the filter may be hydrophobic.

In the preferred embodiment, the well hole has a diameter of approximately 2 mm, the upper wall of the well has a diameter of about 6.9 mm, and the well has a total depth from the top of the upper wall to the hole of about 4.25 mm. These dimensions represent a compromise between a greater depth which allows adding a greater quantity of reagents to the well and a lower depth vis-a-vis the diameter of the upper wall which would allow a broader cone of excitation and emission light to clear the top of the well in reaching and exiting from the concentrated filtered solid phase.

The filter membrane is joined to the top plate by placing the filter membrane into the mold prior to injecting and molding the plastic into the form of a top plate. The walls and base plate may be joined together ultrasonically where causing the top plate to vibrate in turn causes heat to be generated at the point of contact. Upon sufficient heat being generated at the point of contact, the lower end of the four side walls will fuse with the base plate channel receiving the lower end of the four side walls. Alternatively, a seal could be formed using solvents or another source of heat. Furthermore, the side walls could be joined to the base plate at

the molding stage and the side walls subsequently joined to the top plate ultrasonically.

Claims

1. An assay cartridge comprising:

a substantially rectangular top plate (35) having a top side (36) and an underside (37), a plurality of aligned adjacent assay wells (39) disposed in said top plate (35), a filter membrane (71) associated with each of the wells (39), a substantially rectangular base plate (10) connected with and substantially parallel to the top plate (35) to form a sealed waste reservoir (74) between the base plate (10) and the underside (37) of the top plate (35) and,

rear (65), front (66) and first (67) and second (68) walls serially joined to one another, said joined walls having a substantially rectangular cross section, the serially joined walls positioned between and joined to the base plate (10) and top plate (35); and a port (26) in the waste reservoir (74) for facilitating a reduction of pressure in the waste reservoir (74),

wherein each well (39) includes an upper wall portion (41) and a bottom hole (40) having a smaller cross-sectional area than the upper well opening defined by said upper wall portion (41),

wherein each well (39) further includes a lower wall portion (42) tapering from said upper wall portion (41) toward the bottom hole (40),

wherein the bottom hole (40) extends to the underside (37) of the top plate (35), characterised in

that the filter membrane (71) is positioned against the portion of the underside (37) of the top plate (35) to which said bottom hole (40) extends.

2. The assay cartridge of claim 1, wherein the port (26) comprises an opening (27) through the base plate (10) and into the waste reservoir (74) for reducing the pressure in the reservoir (74) relative to the pressure over the wells (39) while maintaining any waste products in the waste reservoir (74).

3. The assay cartridge of claim 2, wherein the port (26) further comprises a tube (27) which extends into the waste reservoir (74).

4. The assay cartridge of any of claims 1 to 3, wherein said upper wall portion (41) of each well (39) has a cylindrical shape and said lower wall portion (42) has the shape of an inverted frustum.

5. The assay cartridge according to any of claims 1 to 4, wherein the filter membrane (71) has a pore size of about 10 microns or less.

6. The assay cartridge according to any of claims 1 to 5, wherein the filter membrane (71) is cellulose acetate, nitrocellulose, polyvinylidene fluoride, polyvinyl chloride, teflon, polysulfone, polyester, polycarbonate, paper or glass fiber.

7. The assay cartridge according to any of claims 1 to 6, wherein

the base plate (10) further comprises rear (11), front (12) and first (13) and second (14) flat base plate side surfaces,

the top plate (35) further comprises rear (48), front (49) and first (50) and second (51) flat top plate side surfaces,

rear (65), front (66) and first (67) and second (68) walls comprise respectively rear (76), front (77) and first (78) and second (79) flat wall side surfaces,

the rear base plate side surface (11), the rear top plate side surface (48), and the rear wall side surface (76) being contiguous and substantially parallel,

the front base plate side surface (12), the front top plate side surface (49), and the front wall side surface (77) being contiguous and substantially parallel,

the first base plate side surface (13), the first top plate side surface (50), and the first wall side surface (78) being contiguous and substantially parallel, and

the second base plate side surface (14), the second top plate side surface (51), and the second wall side surface (79) being contiguous and substantially parallel.

8. The assay cartridge of claim 7, wherein

the rear wall side surface (76) is laterally recessed relative to the rear base plate side surface (11) and the rear top plate side surface (48),

the front wall side surface (77) is laterally recessed relative to the front base plate side surface (12) and the front top plate side surface (49),

the first wall side surface (78) is laterally recessed relative to the first base plate side surface (13) and the first top plate side surface (50), and

the second wall side surface (79) is laterally recessed relative to the second base plate side surface (14) and the second top plate side surface (51).

9. The assay cartridge of claim 8, further com-

prising rear (82) and front (83) centering pegs extending laterally outward respectively from the rear (76) and front (77) wall side surfaces and being substantially opposed to one another.

10. The assay cartridge according to any of claims 7 to 9, wherein

the base plate further comprises first (15) and second (16) flat base plate corner surfaces, the first base plate corner surface (15) located between the first base plate side surface (13) and the front base plate side surface (12), the second base plate corner surface (16) located between the second base plate side surface (14) and the front base plate side surface (12), and

the top plate (35) further comprises first (52) and second (53) top plate corner surfaces, the first top plate corner surface (52) located between the first top plate side

surface (50) and the front top plate side surface (49), the second top plate corner surface (53) located between the second top plate side surface (51) and the front top plate side surface (49).

11. The assay cartridge of claim 10, wherein

the top plate (35) further comprises a top plate raised ridge (55) along the upper periphery of the front (49), rear (48), first (50) and second (51) top plate side surfaces and the first (52) and second (53) top plate corner surfaces,

the base plate further comprises a base plate raised ridge (17) along the lower periphery of the front (12), rear (11), first (13) and second (14) base plate side surfaces and the first (15) and second (16) base plate corner surfaces, and

the top plate raised ridge (55) and the base plate raised ridge (17) having substantially similar configurations and one raised ridge having slightly smaller dimensions than the other raised ridge.

12. The assay cartridge of claim 11, wherein the base plate (10) further comprises a base plate underside (18) and a channel (19) located along the outer periphery of the base plate underside (18) and between the base plate underside (18) and the base plate ridge (17).

13. The assay cartridge according to any of claims 7 to 12, wherein the base plate (10), top plate (35), and four side walls (65 ... 68) are molded plastic, preferably acrylic, polystyrene, or polycarbonate.

Revendicati ns

1. Cartouche pour essai comprenant:

une plaque supérieure sensiblement rectangulaire (35) possédant un côté supérieur (36) et un côté inférieur (37), une pluralité d'orifices d'essai alignés et adjacents (39) disposés dans ladite plaque supérieure (35), une membrane de filtration (71) associée à chacun des orifices (39), une plaque de base sensiblement rectangulaire (10) reliée à la plaque supérieure (35) en en étant sensiblement parallèle pour former un réservoir à déchets fermé de façon étanche entre la plaque de base (10) et le côté inférieur (37) de la plaque supérieure (35), et des parois arrière (65), avant (66), et première (67) et seconde (68) reliées les unes aux autres en série, lesdites parois reliées les unes aux autres étant de section sensiblement rectangulaire, les parois reliées les unes aux autres en série étant positionnées entre et reliées à la plaque de base (10) et à la plaqu supérieure (35), et une embouchure (26) dans le réservoir à déchets (74) pour faciliter la réduction de la pression dans le réservoir à déchets (74),

dans laquelle chaque orifice (39) comprend une portion de paroi supérieure (41) et un trou inférieur (40) dont l'aire en section transversale est inférieure à celle de l'ouverture supérieure de l'orifice défini par ladite portion de paroi supérieure (41),

dans laquelle chaque orifice (39) comprend en outre une portion de paroi inférieure (42) de forme conique partant de ladite portion de paroi supérieure (41) en direction du trou inférieur (40),

dans laquelle le trou inférieur (40) s'étend vers le côté inférieur (37) de la plaque supérieure (35), caractérisée en ce que

la membrane de filtration (71) est positionnée contre la portion du côté inférieur (37) de la plaque supérieure (35) jusqu'à laquelle s'étend ledit trou inférieur (40).

2. Cartouche pour essai selon la revendication 1, dans laquelle l'embouchure (26) comprend une ouverture (27) traversant la plaque de base (10) et allant jusqu'au réservoir à déchets (74) pour réduire la pression dans le réservoir (74) par rapport à la pression sur les orifices (39) tout en maintenant dans le réservoir à déchets (74) tous produits de déchets quelconques.

3. Cartouche pour essai selon la revendication 2, dans laquelle l'embouchure (26) comprend en outre un tube (27) s'étendant dans le réservoir à déchets (74).

4. Cartouche pour essai selon l'une quelconque des revendications 1 à 3, dans laquelle ladite portion de paroi supérieure (41) de chaque orifice (39) est de forme cylindrique et ladite portion de paroi inférieure (42) a la forme d'un tronc de cône inversé.

5. Cartouche pour essai selon l'une quelconque des revendications 1 à 4, dans laquelle la dimension des pores de la membrane de filtration (71) est d'environ 10 microns ou moins.

6. Cartouche pour essai selon l'une quelconque des revendications 1 à 5, dans laquelle la membrane de filtration (71) est en acétate de cellulose, nitrocellulose, fluorure de polyvinylidène, chlorure de polyvinyle, téflon, polysulfone, polyester, polycarbonate, papier ou fibres de verre.

7. Cartouche pour essai selon l'une quelconque des revendications 1 à 6, dans laquelle

la plaque de base (10) comprend en outre des surfaces de plaque de base planes arrière (11), avant (12), et première (13) et seconde (14),

la plaque supérieure (35) comprend en outre des surfaces latérales planes arrière (48), avant (49), et première (50) et seconde (51),

les parois arrière (65), avant (66), et première (67) et seconde (68) comprennent respectivement des surfaces latérales planes arrière (76), avant (77), et première (78) et seconde (79),

la surface latérale arrière (11) de la plaque de base, la surface latérale arrière (48) de la plaque supérieure, et la surface latérale (76) de la paroi arrière étant contiguës et sensiblement parallèles,

la surface latérale avant (12) de la plaque de base, la surface latérale avant (49) de la plaque supérieure et la surface latérale avant (77) de la paroi étant contiguës et sensiblement parallèles,

la première surface latérale (13) de la plaque de base, la première surface latérale (50) de la plaque supérieure et la première surface latérale (78) de la paroi étant contiguës et sensiblement parallèles, et

la seconde surface latérale (14) de la plaque de base, la seconde surface latérale (51) de la plaque supérieure, et la seconde surface latérale (79) de la paroi étant contiguës et sensiblement parallèles.

8. Cartouche pour essai selon la revendication 7, dans laquelle

la surface latérale (76) de la paroi arrière est évidée latéralement par rapport à la surface latérale arrière (11) de la plaque de base et de la surface latérale arrière (48) de la plaque supérieure,

la surface latérale avant (77) de la paroi est évidée latéralement par rapport à la surface latérale avant (12) de la plaque de base et de la surface latérale avant (49) de la plaque supérieure,

la première surface latérale (78) de la paroi est évidée latéralement par rapport à la première surface latérale (13) de la plaque de base et la première surface latérale (50) de la plaque supérieure, et la seconde surface latérale (79) de la paroi est évidée latéralement par rapport à la seconde surface latérale (14) de la plaque de base et la seconde surface latérale (51) de la plaque supérieure.

9. Cartouche pour essai selon la revendication 8, comprenant en outre des ergots de centrage arrière (82) et avant (83) s'étendant latéralement vers l'extérieur respectivement des surfaces latérales de la paroi arrière (76) et de la paroi avant (77) et étant sensiblement à l'opposé l'un à l'autre.

10. Cartouche pour essai selon l'une quelconque des revendications 7 à 9, dans laquelle

la plaque de base comprend en outre des première (15) et seconde (16) surfaces d'angle, la première surface d'angle (15) de la plaque de base étant située entre la première surface latérale (13) de la plaque de base et la surface latérale avant (12) de la plaque de base, la seconde surface d'angle (16) de la plaque de base étant située entre la seconde surface latérale (14) de la plaque de bas et la surface latérale avant (12) de la plaque de base, et

la plaque supérieure (35) comprend en outre des première (52) et seconde (53) surfaces d'angle, la première surface d'angle (52) de la plaque supérieure étant située entre la première surface latérale (50) de la plaque supérieure et la surface latérale avant (49) de la plaque supérieure, la seconde surface d'angle (53) de la plaque supérieure étant située entre la seconde surface latérale (51) de la plaque supérieure et la surface latérale avant (49) de la plaque supéri ure.

11. Cartouche pour essai selon la revendication 10, dans laquelle

la plaque supérieure (35) comprend en utre une nervure en relief (55) le long de la périphéri supérieure des surfaces latérales avant (49), arrière (48), et première (50) et

seconde (51) de la plaque supérieure et les première (52) et seconde (53) surfaces d'angle de la plaque supérieure,

la plaque de base comprend en outre une nervure en relief (17) le long de la périphérie inférieure des surfaces latérales avant (12), arrière (11), première (13) et seconde (14) de la plaque de base et les première (15) et seconde (16) surfaces d'angle de la plaque de base,

la nervure en relief (55) de la plaque supérieure et la nervure en relief (17) de la plaque de base étant de configuration sensiblement similaire et une nervure en relief présentant des dimensions légèrement inférieures à celles de l'autre nervure en relief.

12. Cartouche pour essai selon la revendication 11, dans laquelle la plaque de base (10) comprend en outre un côté inférieur (18) et un conduit (19) situé le long de la périphérie externe du côté inférieur de la plaque de base (18) et entre le côté inférieur (18) de la plaque de base et la nervure (17) de la plaque de base.

13. Cartouche pour essai selon l'une quelconque des revendications 7 à 12, dans laquelle la plaque de base (10), la plaque supérieure (35) et les quatre parois latérales (65...68) sont en matière plastique moulée, de préférence acrylique, polystyrène ou polycarbonate.

Patentansprüche

1. Testsatz, umfassend

eine im wesentlichen rechteckige Deckplatte (35) mit einer Oberseite (36) und einer Unterseite (37), mehrere in der Deckplatte (35) angeordnete ausgerichtete und benachbarte Probenbecher (39), eine jedem Becher (39) zugeordnete Filtermembran (71), eine im wesentlichen rechteckige Grundplatte (10), die mit der Deckplatte (35) verbunden ist und parallel zu dieser verläuft, so daß zwischen der Grundplatte (10) und der Unterseite (37) der Deckplatte (35) ein dichtes Abfallreservoir (74) entsteht, eine Rückwand (65), eine Vorderwand (66), eine erste Wand (67) und eine zweite Wand (68), die der Reihe nach miteinander verbunden sind, im wesenlichen rechteckigen Querschnitt aufweisen und zwischen der Grundplatte (10) und der Deckplatte (35) angeordnet und mit diesen verbunden sind, und eine in dem Abfallreservoir (74) vorgeseh ne Öffnung (26) zur Ermöglichung einer Druckverringerung in dem Abfallreservoir (74),

wob l jeder Becher (39) ein n oberen Wandabschnitt (41) und ein Bodenloch (40) aufweist, das eine geringere Querschnittsfläche hat als die von dem oberen Wandabschnitt (41) definierte obere Becheröffnung,

wobei jeder Becher (39) ferner einen von dem oberen Wandabschnitt (41) in Richtung des Bodenlochs (40) sich verjüngenden unteren Wandabschnitt (42) aufweist, und

wobei das Bodenloch (40) sich zur Unterseite (37) der Deckplatte (35) erstreckt,

dadurch gekennzeichnet, daß die Filtermembran (71) an demjenigen Teil der Unterseite (37) der Deckplatte (35) anliegt, zu dem sich das Bodenloch (40) erstreckt.

2. Testsatz nach Anspruch 1, wobei die Öffnung (26) eine durch die Grundplatte (10) und in das Abfallreservoir (74) verlaufende Öffnung (27) umfaßt, um den Druck in dem Reservoir (74) gegenüber dem Druck über den Bechern (39) zu verringern, während etwaige Abfallprodukte in dem Abfallreservoir (74) zurückgehalten werden.

3. Testsatz nach Anspruch 2, wobei die Öffnung (26) ferner ein in das Abfallreservoir (74) hinein verlaufendes Rohr (27) umfaßt.

4. Testsatz nach einem der Ansprüche 1 bis 3, wobei der obere Wandabschnitt (41) jedes Bechers (39) eine Zylinderform und der untere Wandabschnitt (42) die Form eines umgekehrten Kegelstumpfes aufweist.

5. Testsatz nach einem der Ansprüche 1 bis 4, wobei die Filtermembran (71) eine Porengröße von etwa 10 µm oder weniger hat.

6. Testsatz nach einem der Ansprüche 1 bis 5, wobei die Filtermembran (71) aus Celluloseacetat, Nitrocellulose, Polyvinylidenfluorid, Polyvinylchlorid, Teflon, Polysulfon, Poly ster, Polycarbonat, Papier oder Glasfaser besteht.

7. Testsatz nach einem der Ansprüche 1 bis 6, wobei

die Grundplatte (10) ferner eine hintere (11), eine vordere (12), eine erste (13) und eine zweite (14) ebene Grundplatten-Seitenfläche aufweist,

die Deckplatte (35) ferner eine hintere (48), eine vordere (49), eine erste (50) und eine zweite (51) ebene Deckplatten-Seitenfläche aufweist,

die Rückwand (65), die Vorderwand (66), die erste Wand (67) und die zweite Wand (68) ine hintere (76), eine vordere (77), eine erste (78) und eine zweite (79) ebene Wandseitenfläche aufweist,

die hintere Grundplatten-Seitenfläche (11), die hintere Deckplatten-Seitenfläche (48) und die Rückwand-Seitenfläche (76) aneinandergrenzen und im wesentlichen parallel verlaufen,

die vordere Grundplatten-Seitenfläche (12), die vordere Deckplatten-Seitenfläche (49) und die Vorderwand-Seitenfläche (77) aneinandergrenzen und im wesentlichen parallel verlaufen,

die erste Grundplatten-Seitenfläche (13), die erste Deckplatten-Seitenfläche (50) und die erste Wandseitenfläche (78) aneinandergrenzen und im wesentlichen parallel verlaufen, und

die zweite Grundplatten-Seitenfläche (14), die zweite Deckplatten-Seitenfläche (51) und die zweite Wandseitenfläche (79) aneinandergrenzen und im wesentlichen parallel verlaufen.

8. Testsatz nach Anspruch 7, wobei

die Rückwand-Seitenfläche (76) gegenüber der hinteren Grundplatten-Seitenfläche (11) und der hinteren Deckplatten-Seitenfläche (48) seitlich zurückgesetzt ist,

die Vorderwand-Seitenfläche (77) gegenüber der vorderen Grundplatten-Seitenfläche (12) und der vorderen Deckplatten-Seitenfläche (49) seitlich zurückgesetzt ist,

die erste Wandseitenfläche (78) gegenüber der ersten Grundplatten-Seitenfläche (13) und der ersten Deckplatten-Seitenfläche (50) seitlich zurückgesetzt ist, und

die zweite Wandseitenfläche (79) gegenüber der zweiten Grundplatten-Seitenfläche (14) und der zweiten Deckplatten-Seitenfläche (51) seitlich zurückgesetzt ist.

9. Testsatz nach Anspruch 8, ferner umfassend einen hinteren (82) und einen vorderen (83) Zentrierstift, die von der Rückwand-Seitenfläche (76) bzw. der Vorderwand-Seitenfläche (77) seitlich nach außen ragen und im wesentlichen zueinander entgegengesetzt verlaufen.

10. Testsatz nach einem der Ansprüche 7 bis 9, wobei

die Grundplatte ferner eine erste (15) und eine zweite (16) ebene Grundplatten-Eckfläche aufweist, wobei die erste Grundplatten-Eckfläche (15) zwischen der ersten Grundplatten-Seitenfläche (13) und der vorderen Grundplatten-Seitenfläche (12) und die zweite Grundplatten-Eckfläche (16) zwischen der zweiten Grundplatten-Seitenfläche (14) und der vorderen Grundplatten-Seitenfläche (12) angeordnet ist, und

die Deckplatte (35) ferner eine erste (52) und eine zweite (53) Deckplatten-Eckfläche aufweist, wobei di erste Deckplatten-Eckfläche (52) zwischen der ersten Deckplatten-Seitenfläche (50) und der vorderen Deckplatten-Seitenfläche (49) und die zweite Deckplatten-Eckfläche (53) zwischen der zweiten Deckplatten-Seitenfläche (51) und der vorderen Deckplatten-Seitenfläche(49) angeordnet ist.

11. Testsatz nach anspruch 10, wobei

die Deckplatte (35) ferner eine erhabene Deckplatten-Rippe (55) längs dem oberen Rand der vorderen (49), der hinteren (48), d r ersten (50) und der zweiten (51) Deckplatten-Seitenfläche sowie der ersten (52) und der zweiten (53) Deckplatten-Eckfläche umfaßt,

die Grundplatte ferner eine erhabene Grundplatten-Rippe (17) längs dem unterem Rand der vorderen (12), der hinteren (11), der ersten (13) und der zweiten (14) Grundplatten-Seitenfläche sowie der ersten (15) und d r zweiten (16) Grundplatten-Eckfläche umfaßt, und

die erhabene Deckplatten-Rippe (55) und die erhabene Grundplatten-Rippe (17) im wesentlichen gleiche Konfiguration haben und die eine erhabene Rippe etwas geringere Abmessungen hat als die andere.

12. Testsatz nach Anspruch 11, wobei die Grundplatte (10) ferner eine Grundplatten-Unterseite (18) und einen Kanal (19) aufweist, der am äußeren Rand der Grundplatten-Unterseite (18) sowie zwischen der Grundplatten-Unters ite (18) und der Grundplatten-Rippe (17) angeordnet ist.

13. Testsatz nach einem der Ansprüche 7 bis 12, wobei die Grundplatte (10), die Deckplatte (35) und die vier Seitenwände (65...68) aus geformten Kunststoff, vorzugsweise Acryl, Polystyrol oder Polycarbonat, bestehen.

Fig.1

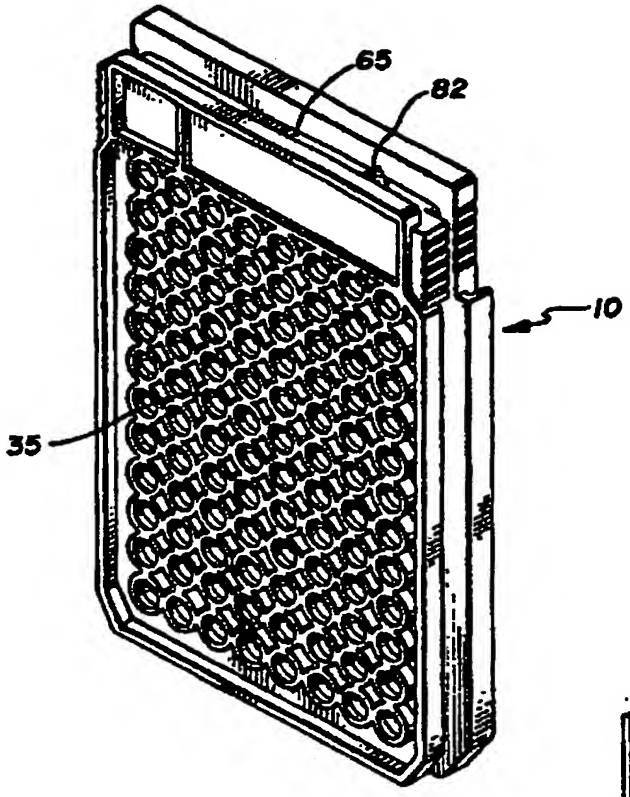

Fig.2

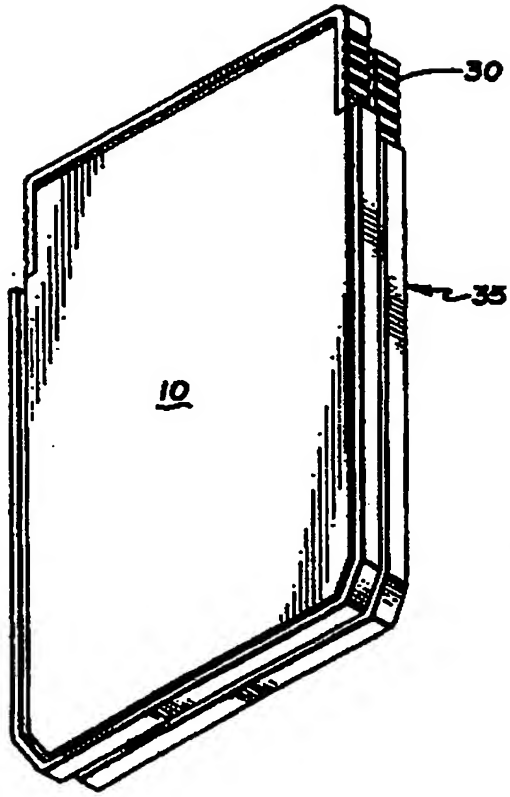

Fig.3

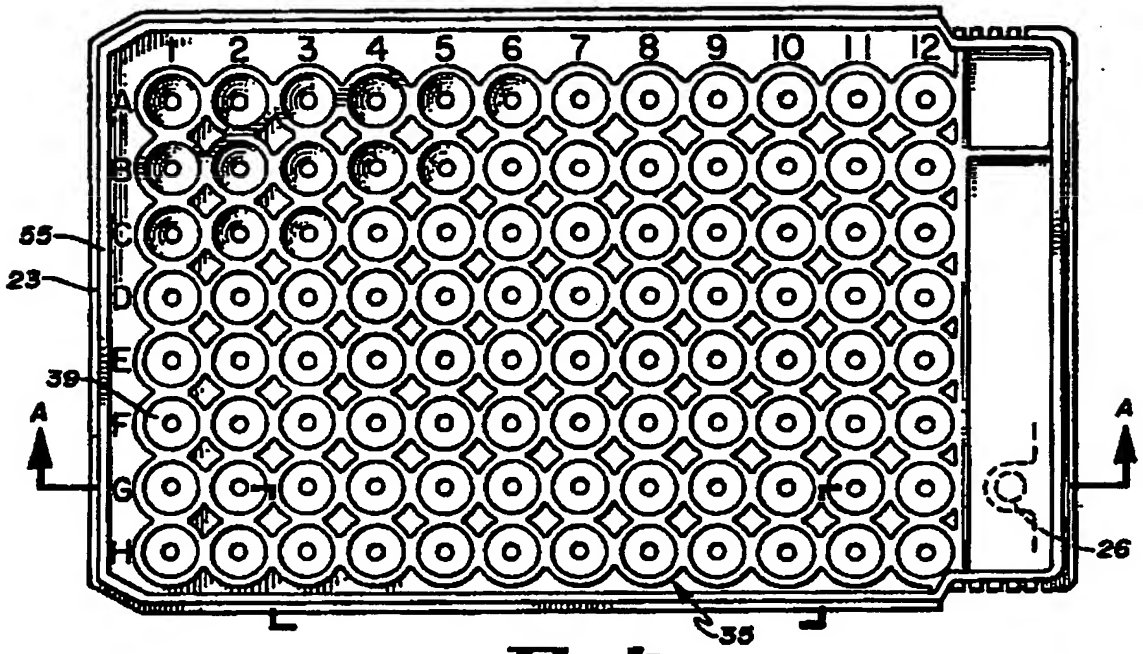

Fig.4

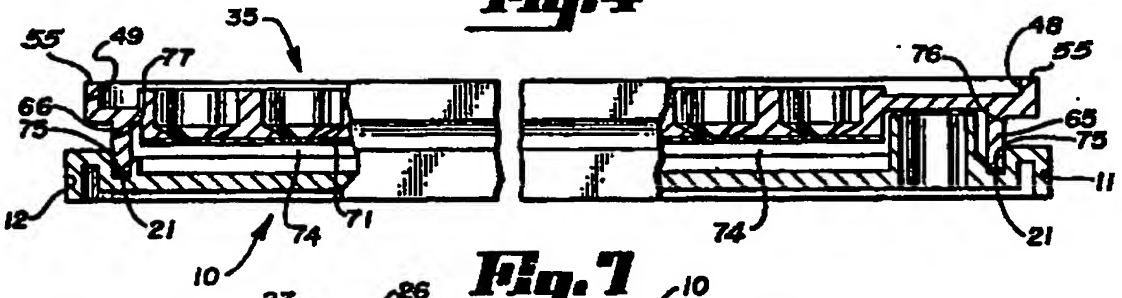

Fig.7

Fig.8

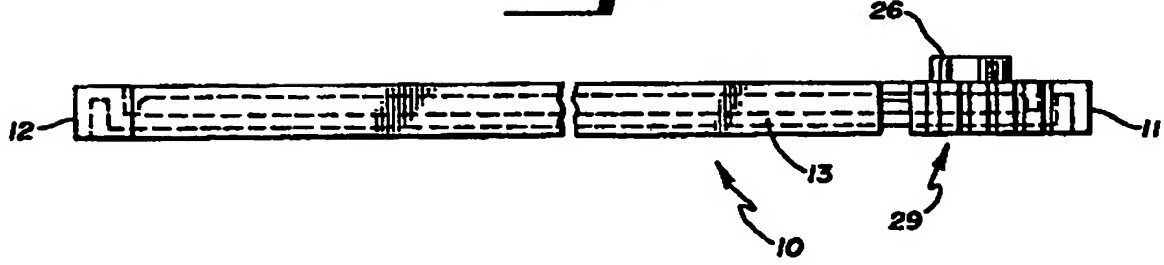

Fig.6

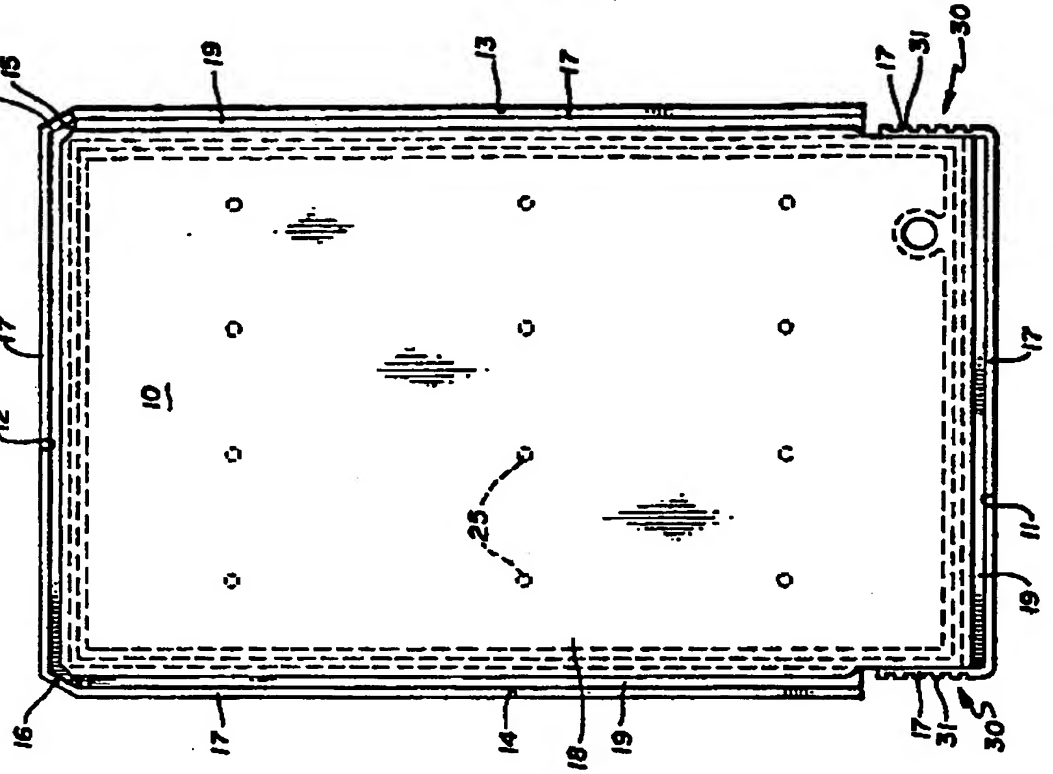
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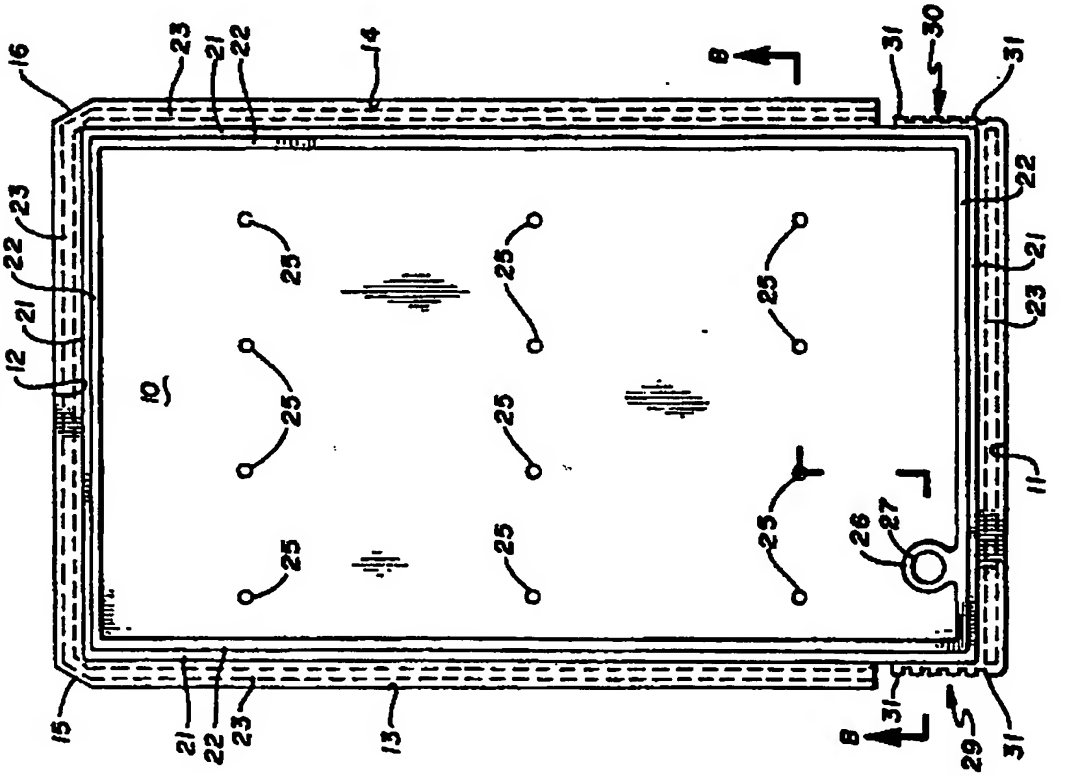
Fig.5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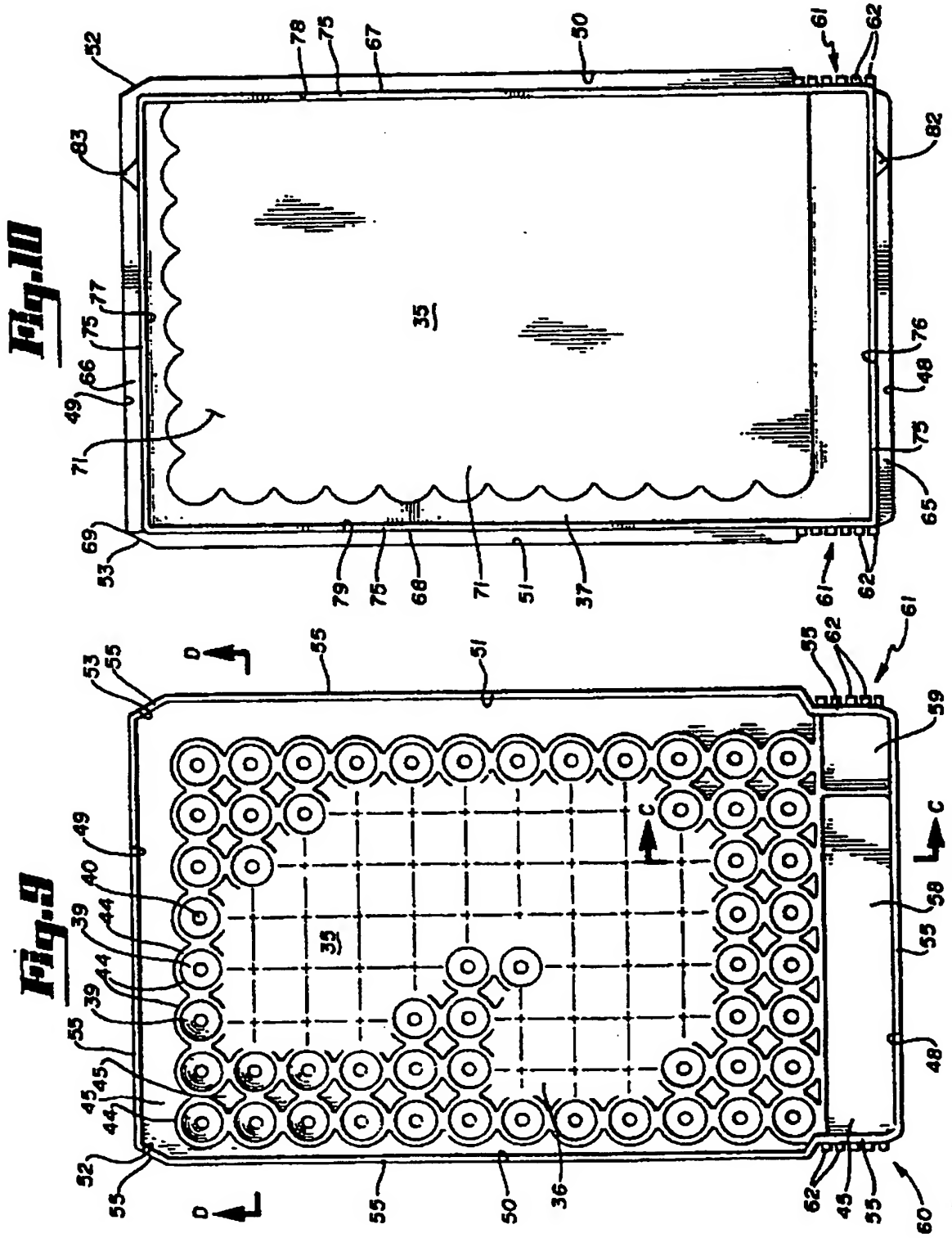
Fig.III
Fig.4
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Fig.11

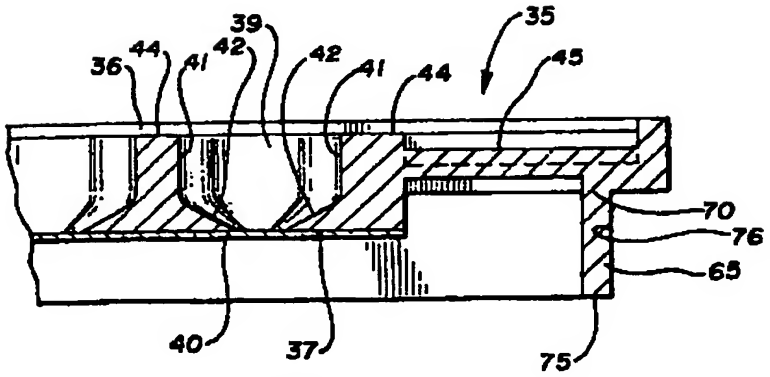

Fig.12

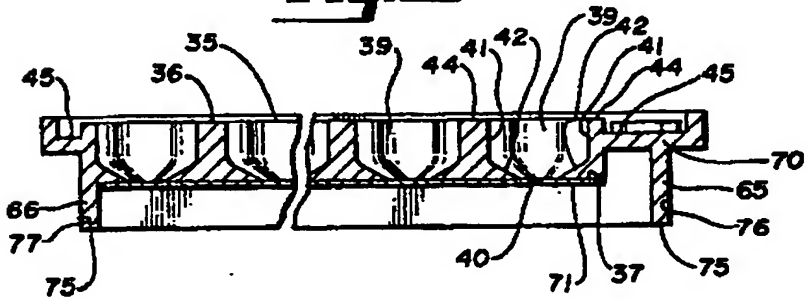

Fig.13